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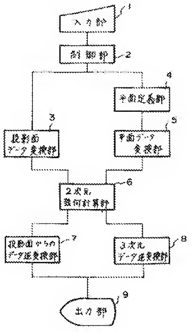
(54)【発明の名称】　3次元図形処理方式

(57)【要約】
【目的】　3次元図形処理中に2次元図形処理を有し、複雑な処理を容易に実施する3次元図形処理方式に関するものである。
【構成】　入力された3次元のデータを制御部2により、投影面上での処理か　要素を含む平面上の処理とするかを分類する。投影面上での処理の場合は、投影面データ変換部3により投影面上の2次元データに変換する。また平面上の処理の場合は、平面定義部4により要素を含む平面定義後、平面データ変換部5により平面上の2次元データに変換する。変換された2次元データを2次元幾何計算部6により結果を求め、投影面からのデータ逆変換部7、3次元データ逆変換部8により、再度3次元データに変換する。



【特許請求の範囲】

【請求項1】 CADシステム入力装置から3次元図形データを入力する入力部と、この入力部によって入力された3次元図形データの処理方式を分類する制御部と、入力部によって入力された3次元図形データを視線方向と垂直に位置する投影面へのデータ変換するための投影面データ変換部と、入力部によって入力された3次元図形データにより一意に定まる平面を決定する平面定義部と、この平面定義部によって求められた平面上でのデータに入力部で入力された3次元図形データをデータ変換するための平面データ変換部と、投影面データ変換部と平面データ変換部により2次元データに変換された図形データにより図形処理計算をおこなう2次元幾何計算部と、この2次元幾何計算部によって算出された投影面上の図形データから投影前の3次元データに逆変換する投影面からのデータ逆変換部と、2次元幾何計算部によって算出された平面上の図形データから、3次元データに逆変換する3次元データ逆変換部と、投影面からのデータ逆変換部と3次元データ逆変換部によって求められた図形データを出力する出力部とを有することを特徴とする3次元図形処理方式。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は3次元CADシステムに関し、特に3次元図形データの編集処理が難しいCADシステムにおいて処理を容易にする3次元図形処理方式に関する。

【0002】

【従来の技術】従来の3次元CADシステムは処理が複雑なため編集処理において高度な3次元の幾何計算処理が必要であった。また、2次元CADシステムでの2次元の幾何計算処理を3次元CADシステムに流用することが不可能であった。

【0003】従来、CADシステム入力装置から3次元図形データを入力する入力部と、入力部によって入力された3次元図形データにより図形処理計算をおこなう3次元幾何計算部と3次元幾何計算部によって算出された図形データを出力する出力部を有する3次元図形処理方式においては3次元の幾何計算処理をする場合、立体的思考能力が必要であり2次元よりも高度なロジックを必要としていた。

【0004】

【発明が解決しようとする課題】上述した従来の3次元図形処理方式は、3次元の幾何計算が非常に複雑となっているため、プログラム作成が困難であった。また、2次元の図形処理とは違い紙上でのイメージ作りが困難なためプログラム作成者の立体的思考能力も必要であるというような問題点があった。

【0005】

【課題を解決するための手段】本発明の3次元図形処理方式は、CADシステム入力装置から3次元図形データを入力する入力部と、この入力部によって入力された3次元図形データの処理方式を分類する制御部と、入力部によって入力された3次元図形データを視線方向と垂直に位置する投影面へのデータ変換するための投影面データ変換部と、入力部によって入力された3次元図形データにより一意に定まる平面を決定する平面定義部と、この平面定義部によって求められた平面上でのデータに入力部で入力された3次元図形データをデータ変換するための平面データ変換部と、投影面データ変換部と平面データ変換部により2次元データに変換された図形データにより図形処理計算をおこなう2次元幾何計算部と、この2次元幾何計算部によって算出された投影面上の図形データから投影前の3次元データに逆変換する投影面からのデータ逆変換部と、2次元幾何計算部によって算出された平面上の図形データから3次元データに逆変換する3次元データ逆変換部と、投影面からのデータ逆変換部と、3次元データ逆変換部によって求められた図形データを出力部する出力とを特徴として有している。

【0006】

【実施例】次に、本発明について図を参照して詳細に説明する。

【0007】図1は、本発明の一実施例の3次元図形処理方式の構成を示すブロック図である。本実施例の3次元図形処理方式は、CADシステム入力装置から3次元図形データを入力する入力部1と、この入力部1によって入力された3次元図形データの処理方式を分類する制御部2と、入力部1によって入力された3次元図形データを視線方向と垂直に位置する投影面へのデータに変換するための投影面データ変換部3と、入力部1によって入力された3次元図形データにより一意に決まる平面を決定する平面定義部4と、この平面定義部4によって求められた平面上でのデータに入力部1で入力された3次元図形データを2次元のデータに変換するための平面データ変換部5と、投影面データ変換部3と平面データ変換部5により2次元データに変換された図形データにより図形処理計算をおこなう2次元幾何計算部6と、この2次元幾何計算部6によって算出された投影面上の図形データから投影前の3次元データに変換する投影面からのデータ逆変換部7と、2次元幾何計算部6によって算出された平面上の図形データから、3次元データに変換する3次元データ逆変換部8と、投影面からのデータ逆変換部7と3次元データ逆変換部8によって求められた図形データを出力する出力部9から構成されている。

【0008】入力部1は、操作者からの動作指示データと、要素入力データと、要素指示データからなる操作者入力データを入力する。入力装置としては、例えばタブレット・スタイラスペン・マウス・キーボード・ファンクションキー等で構成される。

【0009】制御部2は、入力部1によって入力された

操作者入力データのうち動作指示データを解析して投影面上での処理をするのか、要素入力データ・要素指示データを含む平面上での処理をするのかを判断し、前者であれば投影面データ変換部３にデータを送り、後者であれば平面定義部４にデータを送る。

【００１０】投影面データ変換部３は、制御部２によって判断された操作者入力データを受け取り、投影面のデータより要素を投影面上へ投影するための変換マトリクスを求め、３次元の要素データを投影面上の２次元の要素データに変換する。

【００１１】平面定義部４は、制御部２によって判断された操作者入力データを受け取り、要素データにより一意に決定する平面のデータを求める。

【００１２】平面データ変換部５は、平面定義部４により求められた平面データより要素を平面上での２次元のデータに変換するための変換マトリクスを求め、３次元の要素データを平面定義部４により求めた平面上での２次元の要素データに変換する。

【００１３】２次元幾何計算部６は、投影面データ変換部３、平面データ変換部５によって３次元の要素のデータから変換された２次元の要素データと、動作指示データにより２次元の幾何計算処理をおこない、結果を２次元のデータとして出力する。

【００１４】投影面からのデータ逆変換部７は、投影面データ変換部３により要素を投影面上の２次元のデータに変換して、２次元幾何計算部６において、２次元の幾何計算処理をおこなった結果の２次元のデータを元の３次元のデータにもどすための逆変換マトリクスを求め、２次元のデータから３次元のデータに逆変換する。

【００１５】３次元データ逆変換部８は、平面データ変換部５により３次元の要素データを平面上の２次元のデータに変換し、２次元幾何計算部６において２次元の幾何計算処理をおこなった結果の２次元の要素データを元の３次元の要素データにもどすための逆変換マトリクスを求め、２次元の要素データから３次元の要素データに変換する。

【００１６】出力部９は、投影面からのデータ逆変換部７または、３次元データ逆変換部８によって求められた３次元の要素データを操作者に表示する。表示装置としては、例えばディスプレイ・プロッタ・プリンタ等で構成される。

【００１７】図２を参照すると、本実施例の３次元図形処理方式における処理は、操作者入力データ入力ステップ１０と、動作判断ステップ１１と、投影面への変換マトリクス計算ステップ１２と、投影面へのデータ変換ステップ１３と、平面作成ステップ１４と、平面への変換マトリクス計算ステップ１５と、平面へのデータ変換ステップ１６と、２次元幾何計算ステップ１７と、動作判断ステップ１８と、投影面からの逆変換マトリクス計算ステップ１９と、平面からの逆変換マトリクス計算ステップ２０と、３次元データ逆変換ステップ２１と、３次元データ出力ステップ２２とからなる。

【００１８】次に、このように構成された本実施例の３次元図形処理方式を導入した３次元ＣＡＤシステムの動作について説明する。

【００１９】まず、入力部１より操作者による入力が行われる（ステップ１０）。

【００２０】このとき、例えば図３に示すように投影面上での処理をおこなう操作者入力データであるとすると、「線を投影面上の指示位置まで伸縮」という動作指示データ２４と、「線分Ｌ」という要素指示データ２５と、「投影面上の指示位置Ｐ（ｘ３、ｙ３）」であるという要素入力データ２６が操作者入力データとして入力される。また、図４に示すように要素を含む平面上での処理をおこなう操作者入力データであるとすると、「２線の交点を求める」という動作指示データ３０と、「線分Ｌ１、Ｌ２」という要素指示データ３１が操作者入力データとして入力される。

【００２１】次に、制御部２は、入力部１から送られた操作者入力データ（２４、２５、２６、３０、３１）のうち動作指示データ（２４、３０）によって、投影面上での処理を行うか、要素を含む平面上での処理を行うかを判定する（ステップ１１）。動作指示データが投影面上での処理の場合、例えば「線を投影面上の指示位置まで伸縮」という動作指示データ２４であるとすると、投影面データ変換部３に操作者入力データ（２４、２５、２６）を送る。動作指示データが要素を含む平面上での処理の場合、例えば「２線の交点を求める」という動作指示データ３０であるとすると、平面定義部４に操作者入力データ（３０、３１）を送る。

【００２２】ステップ１１で、動作指示データが投影面上での処理の場合には、投影面データ変換部３に操作者入力データが送られ、要素データを投影面上でのデータに変換するための変換マトリクスを求める（ステップ１２）。このとき求めた変換マトリクスを用いて要素データを投影面上での２次元のデータに変換する（ステップ１３）。

【００２３】例えば図３に示すような操作者入力データ（２４、２５、２６）の場合、視線をＺ軸上に一致させＺ成分を無視することによりＸ－Ｙ平面上への投影を可能とする変換マトリクスＭを求める。この変換マトリクスＭを線分の始点、終点に乗ずることにより投影面上の２次元の座標値２７（始点（ｘ１、ｙ１）、終点（ｘ２、ｙ２）に変換される。

【００２４】ステップ１１で、動作指示データが要素を含む平面上での処理の場合には、平面定義部４に操作者入力データが送られ、送られてきた操作者指示データのうち要素指示データにより、要素を含む平面を求める（ステップ１４）。平面定義部４によって求められた平面上のデータに変換するための変換マトリクスを求める

（ステップ１５）。このとき求めた変換マトリクスを用いて要素データを平面上での２次元のデータに変換する（ステップ１６）。

【００２５】例えば図４に示すような操作者入力データ（３０、３１）の場合，線分Ｌ１、Ｌ２を含む平面が求まる。この平面データより，３次元データから平面上の２次元のデータに変換する変換マトリクスＮが求まる。この変換マトリクスＮを線分Ｌ１、Ｌ２の両端点に乗ずることにより，平面上の２次元の座標値３２に変換される。

【００２６】次に，投影面データ変換部３と，平面データ変換部５により求めた２次元の要素データと、操作者入力データを２次元幾何計算部６へ送り、操作者入力データのうちの動作指示データの処理をおこなう（ステップ１７）。例えば，図３に示すような投影面上の線分データ２７と動作指示データ２４と、要素入力データ２６より投影面上での点Ｐから線分Ｌへの垂線の足Ｐ′を求める。よって投影面上において線を投影面上の指示位置まで伸縮させた線分リットル１（始点Ｐ′，終点Ｅ）２８が求まる。また図４に示すような平面上の２次元のデータに変換された線データ３２と動作指示データ３０より，２次元データにおいて２線の交点Ｐ（ｘ，ｙ）３３を求める。

【００２７】次に２次元幾何計算部６で求めた２次元データ（２８、３３）を３次元データに逆変換するため動作指示データ（２４，３０）により変換マトリクスを求める方法を制御する（ステップ１８）。ステップ１８で投影面上での処理であった場合は、投影面上から３次元へのデータ変換をおこなう逆変換マトリクスを求める（ステップ１９）。または、要素を含む平面上での処理であった場合は平面上から３次元へのデータ変換をおこなう逆変換マトリクスを求める（ステップ２０）。ステップ１９で求めた変換マトリクスは投影面からのデータ逆変換部７により３次元のデータに変換される（ステップ２１）。

【００２８】例えば図３に示すように線分リットル１ ２８を投影面上の２次元データから３次元データＬ′（始点（Ｘ１′，Ｙ１′，Ｚ１′），終点（Ｘ２′，Ｙ２′，Ｚ２′））２９に逆変換される。ステップ２０で求めた逆変換マトリクスは，３次元逆変換部８により３次元のデータに逆変換される（ステップ２１）。

【００２９】例えば図４に示すように２線の交点Ｐ３３は平面上の２次元データから３次元データＰ′（Ｘ，Ｙ，Ｚ）３４に逆変換される。投影面からのデータ逆変換部７と３次元データ逆変換部８により求められた３次元データを出力部９に出力する（ステップ２２）。

【００３０】上述の動作の説明では，図３に示した線を投影面上の指示位置まで伸縮する方法と，図４の２線の交点を求める方法を例にとって説明したが、他の幾何計算においても同様の処理方式を用いることが可能である。また、要素が指示されたかどうかの判定にも使用することができる。

【００３１】

【発明の効果】以上説明したように本発明は，入力部，制御部，投影面データ変換部，平面定義部，平面データ変換部，２次元幾何計算部，投影面からのデータ逆変換部、３次元データ逆変換部、出力部を設けたことにより，３次元の図形処理も２次元の図形処理と同様におこなえるため容易な図形処理となる。また，プログラム作成者も２次元的思考能力のみでプログラムの作成が可能であるといった効果がある。

【図面の簡単な説明】

【図１】本発明の一実施例の３次元図形処理方式の構成を示すブロック図。

【図２】本実施例の３次元図形処理方式の処理を示す流れ図。

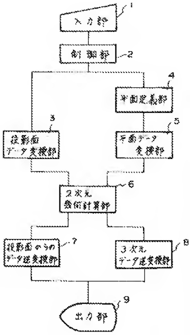
【図３】投影面上の３次元の図形処理の実施方法の一例を示す図。

【図４】２線の交点を求める図形処理の一例を示す図である。

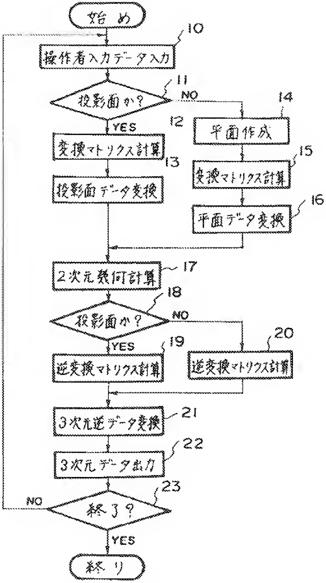
【符号の説明】

１　入力部
２　制御部
３　投影面データ変換部
４　平面定義部
５　平面データ変換部
６　２次元幾何計算部
７　投影面からのデータ逆変換部
８　３次元データ逆変換部
９　出力部

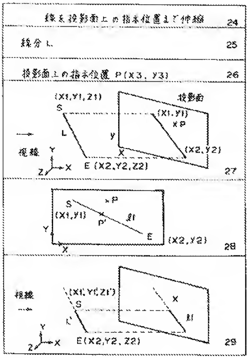
【図1】


入力部
1
制御部
2
平面定義部
4
3
投影面データ変換部
平面データ変換部
5
2次元幾何計算部
6
投影面からのデータ逆変換部
7
3次元データ逆変換部
8
出力部
9

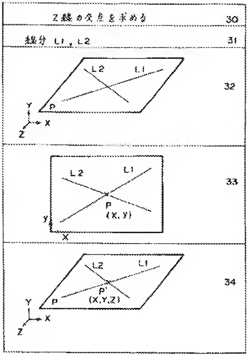
【図2】


始め
10
操作者入力データ入力
11
投影面か？
NO
14
YES
12
平面作成
変換マトリクス計算
13
15
変換マトリクス計算
投影面データ変換
16
平面データ変換
2次元幾何計算
17
18
投影面か？
NO
20
YES
19
逆変換マトリクス計算
逆変換マトリクス計算
3次元逆データ変換
21
22
3次元データ出力
23
NO
終了？
YES
終り

【図3】


線を投影面上の指示位置まで伸縮
24
線分L
25
投影面上の指示位置 P(X3, Y3)
26
(X1,Y1,Z1)
S
投影面
(X1,Y1)
×P
L
y
視線
(X2,Y2)
X
E (X2,Y2,Z2)
27
S
×P
(X1,Y1)
P'
ℓ1
E
(X2,Y2)
28
視線
(X1',Y1',Z1')
S
L'
E(X2,Y2,Z2)
29

【図4】


Z軸の交点を求める
30
線分 L1，L2
31
L2
L1
P
32
L2
L1
P
(X, Y)
33
L2
L1
P'
(X,Y,Z)
P
34

(19) Patent Office of Japan (JP)(11) Publication of Patent Application

JAPANESE PATENT APPLICATION (KOKAI)(A) 5-20404

(43) Publication: Hei-Sei 5 (1993) 1/29

Int. CL. 5 ID Code Office Cont'l No. FI
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Number of claims of the invention: 1

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(22) Filed Date: Hei-Sei 3 (1991) 7/9

(71) Patent Assignee: NEC Corporation; Nagano Nippon Denki Software KK

JP 5-20404

[Note: Names, addresses, company names and brand names are translated in the most common manner. Japanese language does not have singular or plural words unless otherwise specified by a numeral prefix or a general form of plurality suffix.]

(54) [Name of the Invention]

Three-Dimensional Graphic Processing System

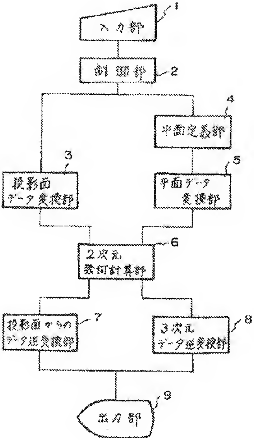
(57) [Summary]

[Goal]

The goal of the present invention is to suggest a three-dimensional graphic processing system, which contains a two-dimensional graphic processing system in a three-dimensional graphic processing system, and which can easily perform complicated processing operations.

[Structure]

A control part 2 classifies whether inputted three-dimensional data is processed on a projection surface or it is processed on a flat plane that contains elements. In the case when it is processed on a projection surface a projection surface data conversion part 3 converts the data into two-dimensional data on the projection surface. Also, in the case of the processing on a flat plane, a flat plane definition part 4 defines the flat plane containing elements and after that a flat plane data conversion part 5 converts the data into two-dimensional data on the flat plane. A two-dimensional geometry calculation part 6 obtains the results from the converted two-dimensional data and the inverse conversion part 7 for data from the projection surface and the inverse conversion part for the three-dimensional data convert the data into three-dimensional data again.



[Scope of the Claims]

[Claim 1]

Three-dimensional graphic (image) processing system characterized by the fact that it contains an input part whereby three-dimensional image data is inputted from a CAD system input device, a control part, which classifies the processing method of the three-dimensional image data that has been input through this input part, a projection surface data conversion part, which is used in order to convert the inputted through the above described input part three-dimensional image data into data onto a projection surface that is positioned vertically relative to the viewing line direction, a flat surface definition part, which completely determines the flat surface from the inputted from the input part three-dimensional image data, a flat surface data conversion part, which is used in order to convert the inputted by the above input part three-dimensional data into data on the top of

the flat surface that is obtained through this flat surface definition part, a two-dimensional geometric calculation part, which performs the image processing calculation from the image data that has been converted to two-dimensional data through the projection surface data conversion part and through the flat surface data conversion part, an inverse conversion part for converting data from the projection surface, whereby from the image data on the projection surface that has been calculated through this two-dimensional geometric calculation part, converts back to the three-dimensional data prior to the projection, a three-dimensional data inverse conversion part, which converts back to three-dimensional data from the calculated through the two-dimensional geometric calculation part image data on the top of the flat surface, and an output part, which outputs the image data that is obtained from the inverse conversion part for the data from the projection surface and from the inverse conversion part for the three-dimensional data.

[Detailed Explanation of the Present Invention]

[0001]

[Technical Field of the Invention]

The present invention is an invention about a three-dimensional CAD system, and especially, the present invention is an invention about an easy processing type three-dimensional image processing system for CAD systems that perform compilation (editing) processing of three-dimensional image data.

[0002]

[Previous Technology]

In the case of the three-dimensional CAD system according to the previous technology, for the compilation processing, because of its complexity, a high order three-dimensional geometric calculation processing has been required. Also, it has not been possible to use the two-dimensional geometric calculation processing performed by the two-dimensional CAD systems in three-dimensional CAD systems.

[0003]

In the past, in the case when a three-dimensional geometric calculation processing is performed by the three-dimensional image processing method, which includes an input part that inputs three-dimensional data from the CAD system input device, a three-dimensional geometric calculation part that performs the image processing calculations from the inputted through the input part three-dimensional image data and an output part that outputs the image data calculated by the three-dimensional geometric calculation data, a three-dimensional logic capability has been required and a higher degree logic has been required than that in the case of the two-dimensional processing.

[0004]

[Problems Solved by the Present Invention]

Regarding the above described three-dimensional image processing method according to the previous technology, because of the fact that the three-dimensional geometric calculation becomes extremely complex, the creation of the program has become very difficult. Also, there has been the problem that because of the fact that it is difficult to generate images on paper that are different from the two-dimensional image processing, the three-dimensional logic (thought) of the people creating the programs has also been required.

[0005]

[Measures in Order to Solve the Problem]

The three-dimensional graphic (image) processing system according to the present invention is characterized by the fact that it contains an input part whereby three-dimensional image data is inputted from a CAD system input device, a control part, which classifies the processing method of the three-dimensional image data that has been input through this input part, a projection surface data conversion part, which is used in order to convert the inputted through the above described input part three-dimensional image data into data onto a projection surface that is positioned vertically relative to the viewing line direction, a flat surface definition part, which completely determines the flat surface from the inputted from the input part three-dimensional image data, a flat surface data conversion part, which is used in order to convert the inputted by the above input part three-dimensional data into data on the top of the flat surface that is obtained through this flat surface definition part, a two-dimensional geometric calculation part, which performs the image processing calculation from the image data that has been converted to two-dimensional data through the projection surface data conversion part and through the flat surface data conversion part, an inverse conversion part for converting data from the projection surface, whereby from the image data on the projection surface that has been calculated through this two-dimensional geometric calculation part, converts back to the three-dimensional data prior to the projection, a three-dimensional data inverse conversion part, which converts back to three-dimensional data from the calculated through the two-dimensional geometric calculation part image data on the top of the flat surface, and an output part, which outputs the image data that is obtained from the inverse conversion part for the data from the projection surface and from the inverse conversion part for the three-dimensional data.

[0006]

[Practical Examples]

After that the present invention will be explained in details by using diagrams as an illustration.

[0007]

Figure 1 is a block diagram showing the structure of the three-dimensional image processing method according to one practical implementation example of the present invention. Regarding the three-dimensional image processing method according to this practical example, it has a structure that is formed from the input part 1, whereby three-dimensional image data is inputted from a CAD system input device, the control part 2, which classifies the processing method of the three-dimensional image data that has been input through this input part 1, the projection surface data conversion part 3, which is used in order to convert the inputted through the above described input part 1 three-dimensional image data into data onto a projection surface that is positioned vertically relative to the viewing line direction, the flat surface definition part 4, which completely determines the flat surface from the inputted from the input part 1 three-dimensional image data, the flat surface data conversion part 5, which is used in order to convert the inputted by the above input part 1 three-dimensional data into data on the top of the flat surface that is obtained through this flat surface definition part, the two-dimensional geometric calculation part 6, which performs the image processing calculation from the image data that has been converted to two-dimensional data through the projection surface data conversion part 3 and through the flat surface data conversion part 5, the inverse conversion part 7 for converting data from the projection surface, whereby from the image data on the projection surface that has been calculated through this two-dimensional geometric calculation part 6, converts back to the three-dimensional data prior to the projection, the three-dimensional data inverse conversion part 8, which converts back to three-dimensional data from the calculated through the two-dimensional geometric calculation part 6 image data on the top of the flat surface, and the output part 9, which outputs the image data that is obtained from the inverse conversion part 7 for the data from the projection surface and from the inverse conversion part 8 for the three-dimensional data.

[0008]

Regarding the input part 1, it inputs the operator input data, which includes the data indicated through the operations conducted by the operator, the required input data, and the required indicated data. As the input device, for example, it is a device that has a structure formed from a tablet – stylus pen – mouse – key board function key, etc.

[0009]

Regarding the control part 2, it separates the operator indicated data within the data that has been input through this input part 1, and conducts a judgment so that it is processed on the projection surface and that the data containing the essential input data – essential

indication data is processed on the top of the flat surface, and if it is the former, the data is forwarded to the projection surface data conversion part 3 and if it is the latter, the data is forwarded to the flat surface definition part 4.

[0010]

Regarding the projection surface data conversion part 3, it receives the selected (judged) by the control part 2, operator input data, and the conversion matrix needed for the projection of the essentials onto the projection surface, is obtained from the projection surface data, and the three-dimensional essential data is converted to two-dimensional essential data on the top of the projection surface.

[0011]

Regarding the flat surface definition part 4, it receives the selected (judged) by the control part 2, operator input data, and through the essential data, the completely defined flat surface data is obtained.

[0012]

Regarding the flat surface data conversion part 5, through the flat surface data obtained from the flat surface definition part 4, the conversion matrix needed in order to convert the essentials on the flat surface to two-dimensional data, is obtained, and the three-dimensional data essential data is converted to two-dimensional essential data on the top of the flat surface that is calculated through the flat surface definition part 4.

[0013]

Regarding the two-dimensional geometric calculation device 6, the two-dimensional geometric calculation is performed from the two-dimensional essential data converted through the projection surface data conversion part 3 and the flat surface data conversion part 5, and from the operator indicated data, and the results are output as two-dimensional data.

[0014]

Regarding the inverse conversion part from the data from the projection surface, it obtains the inverse conversion matrix in order to return the two-dimensional data to three-dimensional data, where the above described two-dimensional data is data, which has been obtained as a result from the processing, where through the projection surface data conversion part 3, the essentials are converted to two-dimensional data on the top of the projection surface, and by using the two-dimensional geometric calculation device 6 the two-dimensional geometric calculation processing has been conducted.

[0015]

Regarding the three-dimensional data inverse conversion part 8, it obtains the inverse conversion matrix needed in order to return the two-dimensional essential data into three-dimensional essential data, where the above described two-dimensional essential data is data, which has been obtained as a result from the processing, where through the flat surface data conversion part 5 the three-dimensional essential data is converted to two-dimensional data on the surface of the flat surface, and through the two-dimensional geometric calculation device 6, the two-dimensional geometric calculation has been conducted.

[0016]

Regarding the output part 9, it displays the three-dimensional essential data to the operator, where the above data is data, which has been obtained through the data inverse conversion part 7 of data from the projection surface, or through the three-dimensional data inverse conversion part 8.

[0017]

Using Figure 2 as an illustration, in the case of the three-dimensional image processing method according to the present practical example, it includes the following: the operator input data, input step 10, the operation evaluation step 11, the step 12 where the conversion matrix to the projection surface is calculated, the projection surface data conversion step 13, the flat surface generation step 14, the step 15 where the matrix for the conversion to the flat surface is calculated, the flat surface data conversion step 16, the two-dimensional geometric calculation step 17, the operation evaluation step 18, the step 19 where the matrix for the inverse conversion from the projection surface is calculated, the step 20 where the matrix for the inverse conversion from the flat surface is calculated, the inverse conversion to three-dimensional data step 21, and the three-dimensional data output step 22.

[0018]

After that, an explanation will be presented regarding the operation of a three-dimensional CAD system where the three-dimensional image processing system according to the present example, which has such described above structure, has been loaded.

[0019]

First, by using the input part 1 the operator input is performed (step 10).

[0020]

At this time, if the operator input data as it is shown in Figure 3, is to be subjected to the projection surface processing, the operator indicated data 24, which states "shrink the line to the position indicated on the surface of the projection surface", the essential indicated

data 25, which states "line part L", and the essential input data 26, which states "indicated position P on the projection surface (x3, y3), are input as the operator input data. Also, if there is the operator input data as shown in Figure 4 that is to be subjected to the processing on the flat surface including the essentials, the operator indicated data 30, which states "obtain the crossing point of 2 lines", and the essentials indicating data 31, which states "line parts L1, L2" are input as operator input data.

[0021]

After that, regarding the control part 2, from the operator indicated data (24, 30) among the forwarded from the input part 1 operator input data (24, 25, 26, 30, 31), it is judged whether the processing on the projection surface or the processing on the flat surface containing the essentials is performed (step 11), and in the case when the operator indicated data is processed on the projection surface, for example, if it is the operator indicated data 24, which states "shrink the line to the position indicated on the surface of the projection surface", the operator input data (24, 25, 26) is forwarded to the projection surface data conversion part 3. In the case where the operator indicated data is processed on the flat surface including the essentials, for example, if it is the operator indicated data 30, which states "obtain the crossing point of 2 lines", the operator input data (30, 31) is forwarded to the flat surface definition part 4.

[0022]

During step 11, in the case when the operator indicated data is processed on the projection surface, the operator input data is forwarded to the projection surface data conversion part 3 and the conversion matrix in order to convert the essential data to data on the projection surface is obtained (step 12). By using the conversion matrix that has been obtained at this time, the essentials data is converted to two-dimensional data on the surface of the projection surface (step 13).

[0023]

For example, in the case of an operator input data (24, 25, 26) as shown according to the presented in Figure 3, the conversion matrix M is obtained whereby a projection on the X-Y flat surface becomes possible as the Z component that matches on the Z axis of the line of vision is made to be invisible. By multiplying the starting point and the final point of the linear component of this conversion matrix M, these are converted to the two-dimensional coordinate value 27 (starting point (x1, y1), final point (x2, y2).

[0024]

At the step 11, in the case when the operator indicated data is processed on the flat surface including the essentials, the operator input data is forwarded to the flat surface definition part 4, and from the essentials indicating data among the forwarded operator indicated data, the flat surface including the essentials is obtained (step 14). The conversion matrix needed in order to convert to the determined by the flat surface

definition part 4, flat surface data, is obtained (step 15). By using the obtained at this time conversion matrix the essentials data is converted to two-dimensional data on the flat surface.

[0025]

For example, in the case of operator input data (30, 31) as shown according to the presented in Figure 4, a flat surface is obtained, which includes the line segments L1, L2. Through this flat surface data, the conversion matrix N, which converts from three-dimensional data to two-dimensional data on the flat surface, is obtained. When this conversion matrix multiplies both end points of the line segments L1 and L2, a conversion to the two-dimensional coordinate value 32 on the flats surface, is performed.

[0026]

After that, the projection surface data conversion part 3, the two-dimensional essential data obtained by the flat surface data conversion part 5, and the operator input data is forwarded to the two-dimensional geometric calculation part 6, and the treatment of the operator indicated data among the operator input data, is performed (step 17). For example, from the point P on the projection surface as shown in Figure 3 obtained from the line segment data 27 on the projection surface, the operator indicated data 24, the essential input data 26, the step P' on a line vertical to the line segment L is obtained. Consequently, on the projection surface the line segment rittoru 1 (starting point P', final point E) 28 where the line has been shrunk to the indicated position, is obtained. Also, from the shown in Figure 4 line data 32, which has been converted to two-dimensional data on the flat surface, and the operator indicated data 30, according to the two-dimensional data the crossing point P (x, y) 33 of the two lines, is obtained.

[0027]

After that, the method for obtaining the conversion matrix in order to convert inversely the obtained by the two-dimensional geometric calculation device 6, two-dimensional data (28, 33), to three-dimensional data is managed by the operator indicated data (24, 30) (step 18). In the case when at step 18 a processing on the projection surface is performed, an inverse conversion matrix is obtained, which performs the data conversion from the projection surface onto three-dimensional data (step 19). Or, in the case of a processing on the flat surface including essentials, the inverse conversion matrix is obtained, which performs the data conversion from the flat surface to three-dimensional data (step 20). The conversion matrix obtained according to the step 19 performs the conversion from the projection surface to three-dimensional data through the inverse data conversion part 7 (step 21).

[0028]

For example, as shown according to the presented in Figure 3, the line segment rittoru 128 is inversely converted from the two-dimensional data on the projection surface to the

three-dimensional data L' (starting point (X1', Y1', Z1'), final point (X2', Y2', Z2') 29. The inverse conversion matrix obtained according to step 20 performs the inverse conversion to three-dimensional data through the three-dimensional inverse conversion part 8 (step 21).

[0029]

For example, as it is shown according to Figure 4, regarding the crossing point P 33 of the two lines, it is converted inversely from the two-dimensional data on the flat surface to the three-dimensional data P' (X, Y, Z) 34. The three-dimensional data that is obtained through the projection surface data inverse conversion part 7 and the three-dimensional data inverse conversion part 8, is output by the output part 9 (step 22).

[0030]

According to the explanation of the above described operation, an explanation has been provided regarding examples of a method for shrinking the line shown in Figure 3 to a position indicated on the projection surface, and a method, shown in Figure 4, for obtaining the crossing point between two lines, however, it is also possible to use the same processing method in other geometric calculations. Also, as the essentials that are indicated any decisions can be used.

[0031]

[Results From the Present Invention]

As it has been explained here above, in the case of the present invention, through a device, which includes an input part, a control part, a projection surface data conversion part, a flat surface definition part, a flat surface data conversion part, a two-dimensional geometric calculation part, an inverse conversion part for data from the projection surface, a three-dimensional data inverse conversion data, and an output part, the three-dimensional image processing can be conducted the same way as a two-dimensional image processing and because of that it becomes an easy processing. Also, there is the result that it is said that the programmers also can generate programs that use only two-dimensional logic capability.

[Brief Explanation of the Figures]

[Figure 1]

Figure 1 represents a block diagram showing the structure of the three-dimensional image processing method according to one practical embodiment of the present invention.

[Figure 2]

Figure 2 is a flow diagram that shows the three-dimensional image processing method according to the present practical embodiment example.

[Figure 3]

Figure 3 is a diagram showing one example of the practical implementation method of the three-dimensional image processing on the projection surface.

[Figure 4]

Figure 4 is a diagram showing one example of the image processing where the crossing between two lines is obtained.

[Explanation of the Symbols]

1..................................input part
2 ....control part
3....................................projection surface data conversion part
4.................................. flat surface definition part
5..................................flat surface data conversion part
6..................................two-dimensional geometric calculation part
7..................................inverse data conversion part from the projection surface
8..................................three-dimensional data inverse conversion part
9. ....output part

In Figure 2:

Top – Start
Steps 10: operator input data input
Step 11: Projection surface?
Step 12: Conversion matrix calculation
Step 13. Projection surface data conversion
Step 14: Producing the flat surface (plane)
Step 15: Conversion matrix calculation
Step 16: flat surface data conversion
Step 17: two-dimensional geometric calculation
Step 18: Projection surface?
Step 19: Inverse conversion matrix calculation
Step 20: Inverse conversion matrix calculation
Step 21: Three-dimensional inverse data conversion
Step 22: Three-dimensional data output
Step 23: Finish?

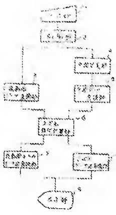
Bottom – End

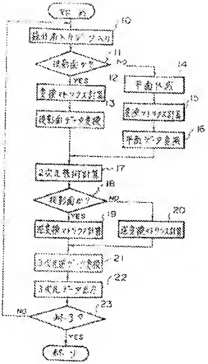
In Figure 3:

24: shrink the line to the position indicated on the projection surface
25: line segment L
26: Position P (X3, Y3) indicated on the projection surface
27: top/right – projection surface, bottom/left – vision line
29: left – vision line

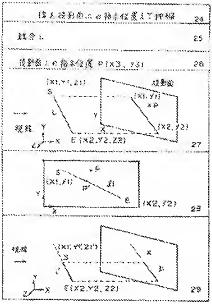
In Figure 4:

30: obtain 2 line crossing point
31: Line segments L1, L2

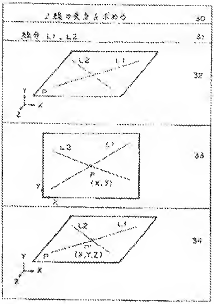



10
11
投影面か？
YES
NO
12
変換マトリックス計算
13
投影面データ変換
14
平面作成
15
変換マトリックス計算
16
平面データ変換
17
18
投影面か？
YES
NO
19
逆変換マトリックス計算
20
逆変換マトリックス計算
21
22
3次元データ出力
23
NO
YES
終り

【図3】



【図4】



Patent Assignees:

NEC Corporation; Nagano Nippon Denki Software KK

Translated by Albena Blagev ((651) 735-1461 (h), (651) 704-7946 (w))

07/28/06

(19) Patent Office of Japan (JP)(11) Publication of Patent Application

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(43) Publication: Hei-Sei 5 (1993) 1/29

Int. CL. 5 ID Code Office Cont'l No. FI
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(71) Patent Assignee: NEC Corporation; Nagano Nippon Denki Software KK

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(54) [Name of the Invention]

Three-Dimensional Graphic Processing System

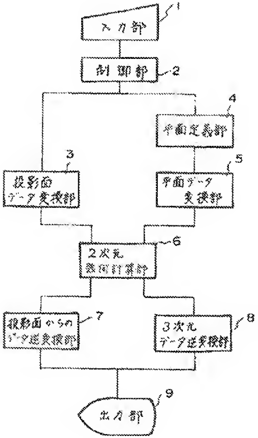
(57) [Summary]

[Goal]

The goal of the present invention is to suggest a three-dimensional graphic processing system, which contains a two-dimensional graphic processing system in a three-dimensional graphic processing system, and which can easily perform complicated processing operations.

[Structure]

A control part 2 classifies whether inputted three-dimensional data is processed on a projection surface or it is processed on a flat plane that contains elements. In the case when it is processed on a projection surface a projection surface data conversion part 3 converts the data into two-dimensional data on the projection surface. Also, in the case of the processing on a flat plane, a flat plane definition part 4 defines the flat plane containing elements and after that a flat plane data conversion part 5 converts the data into two-dimensional data on the flat plane. A two-dimensional geometry calculation part 6 obtains the results from the converted two-dimensional data and the inverse conversion part 7 for data from the projection surface and the inverse conversion part for the three-dimensional data convert the data into three-dimensional data again.



[Scope of the Claims]

[Claim 1]

Three-dimensional graphic (image) processing system characterized by the fact that it contains an input part whereby three-dimensional image data is inputted from a CAD system input device, a control part, which classifies the processing method of the three-dimensional image data that has been input through this input part, a projection surface data conversion part, which is used in order to convert the inputted through the above described input part three-dimensional image data into data onto a projection surface that is positioned vertically relative to the viewing line direction, a flat surface definition part, which completely determines the flat surface from the inputted from the input part three-dimensional image data, a flat surface data conversion part, which is used in order to convert the inputted by the above input part three-dimensional data into data on the top of

the flat surface that is obtained through this flat surface definition part, a two-dimensional geometric calculation part, which performs the image processing calculation from the image data that has been converted to two-dimensional data through the projection surface data conversion part and through the flat surface data conversion part, an inverse conversion part for converting data from the projection surface, whereby from the image data on the projection surface that has been calculated through this two-dimensional geometric calculation part, converts back to the three-dimensional data prior to the projection, a three-dimensional data inverse conversion part, which converts back to three-dimensional data from the calculated through the two-dimensional geometric calculation part image data on the top of the flat surface, and an output part, which outputs the image data that is obtained from the inverse conversion part for the data from the projection surface and from the inverse conversion part for the three-dimensional data.

[Detailed Explanation of the Present Invention]

[0001]

[Technical Field of the Invention]

The present invention is an invention about a three-dimensional CAD system, and especially, the present invention is an invention about an easy processing type three-dimensional image processing system for CAD systems that perform compilation (editing) processing of three-dimensional image data.

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In the case of the three-dimensional CAD system according to the previous technology, for the compilation processing, because of its complexity, a high order three-dimensional geometric calculation processing has been required. Also, it has not been possible to use the two-dimensional geometric calculation processing performed by the two-dimensional CAD systems in three-dimensional CAD systems.

[0003]

In the past, in the case when a three-dimensional geometric calculation processing is performed by the three-dimensional image processing method, which includes an input part that inputs three-dimensional data from the CAD system input device, a three-dimensional geometric calculation part that performs the image processing calculations from the inputted through the input part three-dimensional image data and an output part that outputs the image data calculated by the three-dimensional geometric calculation data, a three-dimensional logic capability has been required and a higher degree logic has been required than that in the case of the two-dimensional processing.

[0004]

[Problems Solved by the Present Invention]

Regarding the above described three-dimensional image processing method according to the previous technology, because of the fact that the three-dimensional geometric calculation becomes extremely complex, the creation of the program has become very difficult. Also, there has been the problem that because of the fact that it is difficult to generate images on paper that are different from the two-dimensional image processing, the three-dimensional logic (thought) of the people creating the programs has also been required.

[0005]

[Measures in Order to Solve the Problem]

The three-dimensional graphic (image) processing system according to the present invention is characterized by the fact that it contains an input part whereby three-dimensional image data is inputted from a CAD system input device, a control part, which classifies the processing method of the three-dimensional image data that has been input through this input part, a projection surface data conversion part, which is used in order to convert the inputted through the above described input part three-dimensional image data into data onto a projection surface that is positioned vertically relative to the viewing line direction, a flat surface definition part, which completely determines the flat surface from the inputted from the input part three-dimensional image data, a flat surface data conversion part, which is used in order to convert the inputted by the above input part three-dimensional data into data on the top of the flat surface that is obtained through this flat surface definition part, a two-dimensional geometric calculation part, which performs the image processing calculation from the image data that has been converted to two-dimensional data through the projection surface data conversion part and through the flat surface data conversion part, an inverse conversion part for converting data from the projection surface, whereby from the image data on the projection surface that has been calculated through this two-dimensional geometric calculation part, converts back to the three-dimensional data prior to the projection, a three-dimensional data inverse conversion part, which converts back to three-dimensional data from the calculated through the two-dimensional geometric calculation part image data on the top of the flat surface, and an output part, which outputs the image data that is obtained from the inverse conversion part for the data from the projection surface and from the inverse conversion part for the three-dimensional data.

[0006]

[Practical Examples]

After that the present invention will be explained in details by using diagrams as an illustration.

[0007]

Figure 1 is a block diagram showing the structure of the three-dimensional image processing method according to one practical implementation example of the present invention. Regarding the three-dimensional image processing method according to this practical example, it has a structure that is formed from the input part 1, whereby three-dimensional image data is inputted from a CAD system input device, the control part 2, which classifies the processing method of the three-dimensional image data that has been input through this input part 1, the projection surface data conversion part 3, which is used in order to convert the inputted through the above described input part 1 three-dimensional image data into data onto a projection surface that is positioned vertically relative to the viewing line direction, the flat surface definition part 4, which completely determines the flat surface from the inputted from the input part 1 three-dimensional image data, the flat surface data conversion part 5, which is used in order to convert the inputted by the above input part 1 three-dimensional data into data on the top of the flat surface that is obtained through this flat surface definition part, the two-dimensional geometric calculation part 6, which performs the image processing calculation from the image data that has been converted to two-dimensional data through the projection surface data conversion part 3 and through the flat surface data conversion part 5, the inverse conversion part 7 for converting data from the projection surface, whereby from the image data on the projection surface that has been calculated through this two-dimensional geometric calculation part 6, converts back to the three-dimensional data prior to the projection, the three-dimensional data inverse conversion part 8, which converts back to three-dimensional data from the calculated through the two-dimensional geometric calculation part 6 image data on the top of the flat surface, and the output part 9, which outputs the image data that is obtained from the inverse conversion part 7 for the data from the projection surface and from the inverse conversion part 8 for the three-dimensional data.

[0008]

Regarding the input part 1, it inputs the operator input data, which includes the data indicated through the operations conducted by the operator, the required input data, and the required indicated data. As the input device, for example, it is a device that has a structure formed from a tablet – stylus pen – mouse – key board function key, etc.

[0009]

Regarding the control part 2, it separates the operator indicated data within the data that has been input through this input part 1, and conducts a judgment so that it is processed on the projection surface and that the data containing the essential input data – essential

indication data is processed on the top of the flat surface, and if it is the former, the data is forwarded to the projection surface data conversion part 3 and if it is the latter, the data is forwarded to the flat surface definition part 4.

[0010]

Regarding the projection surface data conversion part 3, it receives the selected (judged) by the control part 2, operator input data, and the conversion matrix needed for the projection of the essentials onto the projection surface, is obtained from the projection surface data, and the three-dimensional essential data is converted to two-dimensional essential data on the top of the projection surface.

[0011]

Regarding the flat surface definition part 4, it receives the selected (judged) by the control part 2, operator input data, and through the essential data, the completely defined flat surface data is obtained.

[0012]

Regarding the flat surface data conversion part 5, through the flat surface data obtained from the flat surface definition part 4, the conversion matrix needed in order to convert the essentials on the flat surface to two-dimensional data, is obtained, and the three-dimensional data essential data is converted to two-dimensional essential data on the top of the flat surface that is calculated through the flat surface definition part 4.

[0013]

Regarding the two-dimensional geometric calculation device 6, the two-dimensional geometric calculation is performed from the two-dimensional essential data converted through the projection surface data conversion part 3 and the flat surface data conversion part 5, and from the operator indicated data, and the results are output as two-dimensional data.

[0014]

Regarding the inverse conversion part from the data from the projection surface, it obtains the inverse conversion matrix in order to return the two-dimensional data to three-dimensional data, where the above described two-dimensional data is data, which has been obtained as a result from the processing, where through the projection surface data conversion part 3, the essentials are converted to two-dimensional data on the top of the projection surface, and by using the two-dimensional geometric calculation device 6 the two-dimensional geometric calculation processing has been conducted.

[0015]

Regarding the three-dimensional data inverse conversion part 8, it obtains the inverse conversion matrix needed in order to return the two-dimensional essential data into three-dimensional essential data, where the above described two-dimensional essential data is data, which has been obtained as a result from the processing, where through the flat surface data conversion part 5 the three-dimensional essential data is converted to two-dimensional data on the surface of the flat surface, and through the two-dimensional geometric calculation device 6, the two-dimensional geometric calculation has been conducted.

[0016]

Regarding the output part 9, it displays the three-dimensional essential data to the operator, where the above data is data, which has been obtained through the data inverse conversion part 7 of data from the projection surface, or through the three-dimensional data inverse conversion part 8.

[0017]

Using Figure 2 as an illustration, in the case of the three-dimensional image processing method according to the present practical example, it includes the following: the operator input data, input step 10, the operation evaluation step 11, the step 12 where the conversion matrix to the projection surface is calculated, the projection surface data conversion step 13, the flat surface generation step 14, the step 15 where the matrix for the conversion to the flat surface is calculated, the flat surface data conversion step 16, the two-dimensional geometric calculation step 17, the operation evaluation step 18, the step 19 where the matrix for the inverse conversion from the projection surface is calculated, the step 20 where the matrix for the inverse conversion from the flat surface is calculated, the inverse conversion to three-dimensional data step 21, and the three-dimensional data output step 22.

[0018]

After that, an explanation will be presented regarding the operation of a three-dimensional CAD system where the three-dimensional image processing system according to the present example, which has such described above structure, has been loaded.

[0019]

First, by using the input part 1 the operator input is performed (step 10).

[0020]

At this time, if the operator input data as it is shown in Figure 3, is to be subjected to the projection surface processing, the operator indicated data 24, which states "shrink the line to the position indicated on the surface of the projection surface", the essential indicated

data 25, which states "line part L", and the essential input data 26, which states "indicated position P on the projection surface (x3, y3), are input as the operator input data. Also, if there is the operator input data as shown in Figure 4 that is to be subjected to the processing on the flat surface including the essentials, the operator indicated data 30, which states "obtain the crossing point of 2 lines", and the essentials indicating data 31, which states "line parts L1, L2" are input as operator input data.

[0021]

After that, regarding the control part 2, from the operator indicated data (24, 30) among the forwarded from the input part 1 operator input data (24, 25, 26, 30, 31), it is judged whether the processing on the projection surface or the processing on the flat surface containing the essentials is performed (step 11), and in the case when the operator indicated data is processed on the projection surface, for example, if it is the operator indicated data 24, which states "shrink the line to the position indicated on the surface of the projection surface", the operator input data (24, 25, 26) is forwarded to the projection surface data conversion part 3. In the case where the operator indicated data is processed on the flat surface including the essentials, for example, if it is the operator indicated data 30, which states "obtain the crossing point of 2 lines", the operator input data (30, 31) is forwarded to the flat surface definition part 4.

[0022]

During step 11, in the case when the operator indicated data is processed on the projection surface, the operator input data is forwarded to the projection surface data conversion part 3 and the conversion matrix in order to convert the essential data to data on the projection surface is obtained (step 12). By using the conversion matrix that has been obtained at this time, the essentials data is converted to two-dimensional data on the surface of the projection surface (step 13).

[0023]

For example, in the case of an operator input data (24, 25, 26) as shown according to the presented in Figure 3, the conversion matrix M is obtained whereby a projection on the X-Y flat surface becomes possible as the Z component that matches on the Z axis of the line of vision is made to be invisible. By multiplying the starting point and the final point of the linear component of this conversion matrix M, these are converted to the two-dimensional coordinate value 27 (starting point (x1, y1), final point (x2, y2).

[0024]

At the step 11, in the case when the operator indicated data is processed on the flat surface including the essentials, the operator input data is forwarded to the flat surface definition part 4, and from the essentials indicating data among the forwarded operator indicated data, the flat surface including the essentials is obtained (step 14). The conversion matrix needed in order to convert to the determined by the flat surface

definition part 4, flat surface data, is obtained (step 15). By using the obtained at this time conversion matrix the essentials data is converted to two-dimensional data on the flat surface.

[0025]

For example, in the case of operator input data (30, 31) as shown according to the presented in Figure 4, a flat surface is obtained, which includes the line segments L1, L2. Through this flat surface data, the conversion matrix N, which converts from three-dimensional data to two-dimensional data on the flat surface, is obtained. When this conversion matrix multiplies both end points of the line segments L1 and L2, a conversion to the two-dimensional coordinate value 32 on the flats surface, is performed.

[0026]

After that, the projection surface data conversion part 3, the two-dimensional essential data obtained by the flat surface data conversion part 5, and the operator input data is forwarded to the two-dimensional geometric calculation part 6, and the treatment of the operator indicated data among the operator input data, is performed (step 17). For example, from the point P on the projection surface as shown in Figure 3 obtained from the line segment data 27 on the projection surface, the operator indicated data 24, the essential input data 26, the step P' on a line vertical to the line segment L is obtained. Consequently, on the projection surface the line segment rittoru 1 (starting point P', final point E) 28 where the line has been shrunk to the indicated position, is obtained. Also, from the shown in Figure 4 line data 32, which has been converted to two-dimensional data on the flat surface, and the operator indicated data 30, according to the two-dimensional data the crossing point P (x, y) 33 of the two lines, is obtained.

[0027]

After that, the method for obtaining the conversion matrix in order to convert inversely the obtained by the two-dimensional geometric calculation device 6, two-dimensional data (28, 33), to three-dimensional data is managed by the operator indicated data (24, 30) (step 18). In the case when at step 18 a processing on the projection surface is performed, an inverse conversion matrix is obtained, which performs the data conversion from the projection surface onto three-dimensional data (step 19). Or, in the case of a processing on the flat surface including essentials, the inverse conversion matrix is obtained, which performs the data conversion from the flat surface to three-dimensional data (step 20). The conversion matrix obtained according to the step 19 performs the conversion from the projection surface to three-dimensional data through the inverse data conversion part 7 (step 21).

[0028]

For example, as shown according to the presented in Figure 3, the line segment rittoru 128 is inversely converted from the two-dimensional data on the projection surface to the

three-dimensional data L' (starting point (X1', Y1', Z1'), final point (X2', Y2', Z2') 29. The inverse conversion matrix obtained according to step 20 performs the inverse conversion to three-dimensional data through the three-dimensional inverse conversion part 8 (step 21).

[0029]

For example, as it is shown according to Figure 4, regarding the crossing point P 33 of the two lines, it is converted inversely from the two-dimensional data on the flat surface to the three-dimensional data P' (X, Y, Z) 34. The three-dimensional data that is obtained through the projection surface data inverse conversion part 7 and the three-dimensional data inverse conversion part 8, is output by the output part 9 (step 22).

[0030]

According to the explanation of the above described operation, an explanation has been provided regarding examples of a method for shrinking the line shown in Figure 3 to a position indicated on the projection surface, and a method, shown in Figure 4, for obtaining the crossing point between two lines, however, it is also possible to use the same processing method in other geometric calculations. Also, as the essentials that are indicated any decisions can be used.

[0031]

[Results From the Present Invention]

As it has been explained here above, in the case of the present invention, through a device, which includes an input part, a control part, a projection surface data conversion part, a flat surface definition part, a flat surface data conversion part, a two-dimensional geometric calculation part, an inverse conversion part for data from the projection surface, a three-dimensional data inverse conversion data, and an output part, the three-dimensional image processing can be conducted the same way as a two-dimensional image processing and because of that it becomes an easy processing. Also, there is the result that it is said that the programmers also can generate programs that use only two-dimensional logic capability.

[Brief Explanation of the Figures]

[Figure 1]

Figure 1 represents a block diagram showing the structure of the three-dimensional image processing method according to one practical embodiment of the present invention.

[Figure 2]

Figure 2 is a flow diagram that shows the three-dimensional image processing method according to the present practical embodiment example.

[Figure 3]

Figure 3 is a diagram showing one example of the practical implementation method of the three-dimensional image processing on the projection surface.

[Figure 4]

Figure 4 is a diagram showing one example of the image processing where the crossing between two lines is obtained.

[Explanation of the Symbols]

1.................................input part
2.................................control part
3.................................projection surface data conversion part
4.................................flat surface definition part
5.................................flat surface data conversion part
6.................................two-dimensional geometric calculation part
7.................................inverse data conversion part from the projection surface
8.................................three-dimensional data inverse conversion part
9.................................output part

In Figure 2:

Top – Start
Steps 10: operator input data input
Step 11: Projection surface?
Step 12: Conversion matrix calculation
Step 13: Projection surface data conversion
Step 14: Producing the flat surface (plane)
Step 15: Conversion matrix calculation
Step 16: flat surface data conversion
Step 17: two-dimensional geometric calculation
Step 18: Projection surface?
Step 19: Inverse conversion matrix calculation
Step 20: Inverse conversion matrix calculation
Step 21: Three-dimensional inverse data conversion
Step 22: Three-dimensional data output
Step 23: Finish?

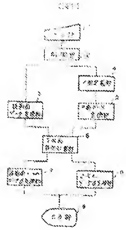
Bottom – End

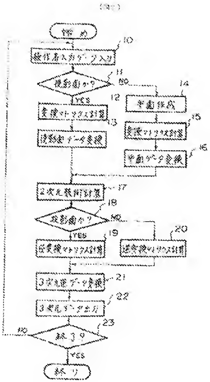
In Figure 3:

24: shrink the line to the position indicated on the projection surface
25: line segment L
26: Position P (X3, Y3) indicated on the projection surface
27: top/right – projection surface, bottom/left -- vision line
29: left – vision line

In Figure 4:

30: obtain 2 line crossing point
31: Line segments L1, L2

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14
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17
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22
23
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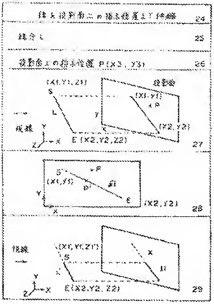
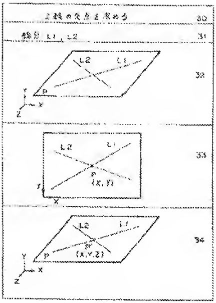
YES
終了?
終り

【図3】



【図4】



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